

ENCLOSURE 2

AP-42 EMISSION FACTOR BACKGROUND DOCUMENTATION PRESSURE SENSITIVE TAPE AND LABEL SURFACE COATING OPERATIONS

This section contains the data and calculations used in determining the VOC emission factors for pressure sensitive tape and label (PSTL) surface coating operations. The emission factors are presented in Table 4.10-1 of AP-42. VOC emissions are the only air pollutants discussed. The reasoning and assumptions used in selecting the emission factors are presented in this documentation.

The emission factors are expressed as a ratio of the mass of VOC emitted per mass of total solvent used. Where applicable, ranges were given to show the degree of variability involved in the large variety of PSTL coating operations. Only a single factor is given for control device emissions, however, because this factor is set by the capture and control device efficiencies inherent in the two control levels (85 and 90 percent) examined. Emissions from uncontrolled coating lines are described as occurring from drying oven exhausts, fugitive solvent vapors, and from solvent retained in the product. For controlled coating lines, the drying oven exhaust emissions are replaced by much lower control device outlet emissions. Each category of emission factors is discussed below.

I. Uncontrolled Emission Factors¹⁻⁵

Emission factors for uncontrolled coating lines are based on the combination of information from EPA's Control Techniques Guideline (CTG) document for surface coating and information on coating line emissions obtained from various tape and label manufacturers. The primary assumption applied to this information was that 100 percent of the total solvent used at the coating line is vaporized and emitted to the atmosphere. Information from several coaters of pressure sensitive tape and label products indicates that from 80 to 95 percent of the total solvent used is emitted through drying oven exhausts. Although no hard data existed on product solvent retentions, manufacturers in the tape and label industry estimated the retention to be from one to five percent of the total solvent used. This retention range was assumed to remain the same in both the controlled and uncontrolled cases. The fugitive emission factors were determined from data submitted by tape and label coaters and by estimating the differences between total emissions and other point source emissions. Factors such as line speed, web width, solvent volatility, solvent temperature, and coating head configuration all affect fugitive emission levels. A summary of all point source emission factors for the PSTL industry is given below:

<u>Emission Points</u>	<u>kg/kg (lb/lb)</u>
Drying Oven Exhaust	0.80-0.95
Fugitives	0.01-0.15
<u>Printed Product</u>	<u>0.01-0.05</u>
Total Emissions	1.00

Facility: Individual coating line.

II. Eighty-five Percent Controlled Emission Factors¹⁻⁶

Emission factors representing 85 percent overall control are based on existing coating lines which are equipped with older-type design VOC control systems. In the 85 percent case only drying oven exhausts are captured. No test data are available for these type controlled coating lines. The overall control efficiency and control device efficiency were determined from recommendations presented in EPA's CTG document on the PSTL industry, from VOC control information submitted by various PSTL firms, and from limited test data on older PSTL facilities.

The overall control efficiency is based on a control device efficiency of 95 percent and a capture system efficiency of 90 percent. The control device (either fixed-bed carbon adsorption or incineration) efficiency was reported to range between 90 and 99 percent. A 95 percent efficiency was chosen as a control level representative of normal long-term operation. No method was available to directly calculate the efficiency of the solvent vapor capture system. However, from back calculating by dividing the overall control efficiency by the control device efficiency, a solvent vapor capture system efficiency of 90 percent should be expected.

There are three major emission points in a PSTL coating line. The emissions from the first point, the control device outlet, were determined by knowing the capture system efficiency and the control device efficiency as follows:

$$\begin{aligned}
 \text{Control Device Emission Factor} &= (\text{Capture Efficiency}) \times (1 - \text{Control Device Efficiency}) \\
 &= 0.90 \quad \times \quad (1-0.95) \\
 &= \underline{0.045 \text{ mass VOC emitted/mass total solvent used}}
 \end{aligned}$$

The control device outlet emission factor is not a range because a specified quantity (90 percent) of emissions is directed to a device which controls the emissions to a specified level (95 percent).

The emission factors for the second point, product solvent retention, were determined from data gathered from PSTL companies. Industry sources reported that, depending on the particular product, solvent retentions range from one to five percent of the total solvent used at the coating line. The emission factors for the third point source, fugitives, were determined by calculating the difference between total emissions and other point source emissions. All point source emission factors under 85 percent control are summarized as follows:

<u>Emission Point</u>	<u>kg/kg (lb/lb)</u>
Fugitives	0.055-0.095
Product Retention	0.01-0.05
<u>Control Device</u>	<u>0.045</u>
Total Emissions	0.15

Facility: Individual coating line controlled by fixed-bed carbon adsorption or incineration with no provisions for fugitive vapor capture.

III. Ninety Percent Controlled Emission Factors⁷⁻¹⁴

Emission factors representing 90 percent overall control are based on the best demonstrated control technology for PSTL coating line emissions. In this system fugitive VOC emissions as well as drying oven exhausts are captured. The data base consists of short-term EPA test results and long-term plant data from two PSTL facilities. The short-term test data results were based on gas-phase analyses of the solvent laden air streams in and out of the control devices. This test supported the EPA contention that VOC control devices are at least 95 percent efficient. Long-term plant data from the same tested facility indicated that overall control efficiencies of from 79.9 to 99.9 percent were being achieved. The lower figure of 79.9 is not typical of the tested facility. The use of activated carbon past its replacement point caused the control system efficiency to degrade. Long-term data from a second facility indicated that an overall control efficiency of 93 percent is achievable. Both sets of long-term data were based on overall solvent volume material balances. The combination and analysis of the long-term data results demonstrates that on the average, 90 percent overall control is reasonable for new facilities in this industry.

The 93 percent overall control efficiency of the second facility was in part achieved by a control device which had a reported efficiency of 97 percent. By calculating back, a corresponding capture system efficiency of 95 percent can be obtained. The best demonstrated capture technology is represented by this system.

For 90 percent control the total mass emission factor is 0.10. The control device outlet emission factor was determined by knowing the capture system and control device efficiency as follows:

$$\begin{aligned}
 \text{Control Device Emission Factor} &= \left(\frac{\text{Capture Efficiency}}{\text{Efficiency}} \right) \times \left(1 - \frac{\text{Control Device Efficiency}}{\text{Efficiency}} \right) \\
 &= 0.95 \times (1 - 0.95) \\
 &= \underline{0.0475 \text{ mass VOC emitted/mass total solvent used}}
 \end{aligned}$$

The emission factors for the product solvent retention source were assumed to be the same as for the uncontrolled and 85 percent control cases. The fugitive emission factors were again determined by the difference between total emissions and other point source emissions. A summary of the emission factors for the 90 percent control case is given below:

<u>Emission Point</u>	<u>kg/kg (lb/lb)</u>
Fugitives	0.002-0.042
Product Retention	0.01-0.05
<u>Control Device</u>	<u>0.0475</u>
Total Emissions	0.10

Facility: Individual coating line controlled by modern solvent vapor capture system and either fixed-bed carbon adsorption or incineration.

References

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